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De-Ionized Water (DIW)
Interface Control Document
for the
Generation-3
Personnel Safety System
(PSS)
of the
Advanced Photon Source
at
Argonne National Laboratory
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WBS X.1.4.1.4

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NOTIFICATION OF SPECIFICATION REVISION - INDEX OF PAGE REVISIONS

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1. Introduction

1.1. Scope

This document defines the interface between the PSS and the DIW system used to cool critical components in the beamline. It also defines the interface between the DIW system and the EPICS for remote monitoring of proper system operation.

1.2. Definitions, acronyms, and abbreviations

The following are some of the frequently appearing or unique acronyms used in this document. This list is provided as a quick reference for the reader's convenience.

ACIS	Access Control Interlock System
APS	Advanced Photon Source
ASD	Accelerator Systems Division
C&C	Command and Control
DIW	De-Ionized Water
DOE	Department Of Energy
EPICS	Experimental Physics and Industrial Control System
ES&H	Environment, Safety & Health Manual
ESD	Emergency Shut Down
FOE	First Optics Enclosure
HMI	Human Machine Interface
IOC	Input Output Controller (data collection for EPICS)
LAN	Local Area Network
OI	Operator Interface
PSS	Personnel Safety System
PLC(s)	Programmable Logic Controller(s)
PMD	Programmable Message Display
SAD	Safety Assessment Document
SDD	Software Design Document
SyRS	System Requirements Specification
TBD	To Be Defined/Decided
VME	Versa Module Euro card
XFD	Experimental Facilities Division

1.3. Applicable Documents

The following documents form a part of this specification to the extent specified herein.

APS Documents

Document No. 1111-00001 APS Quality Assurance Plan, dated May 1990.

Drawings

DIW Mechanical Drawings

Drawing No.4104xxxx-212225 beamline dependent – Mechanical Engineering and Installation Drawing

Electrical Schematics

Drawing Nos.4104xxxx-212053 beamline dependent – PSS to DIW Interconnection drawing.

Precedence

In the event of conflict between the provisions of this specification and other documents, the following precedence shall apply:

The documents specified in section 1.4 References as applicable to this document.
This specification.

1.4. References

Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Department of Energy (DOE) ORDER 420.2A, 01-08-01
Accelerator Safety Implementation Guide for DOE O 420.2A, Draft, August 2001
DOE ORDER 5480.25, 11-3-92
DOE GUIDANCE 5480.25, September 1, 1993

DOE ORDER and GUIDANCE 5480.25 are included because they were in effect and referenced when the Safety Assessment Document (SAD) was originally written; it has been superseded by DOE ORDER 420.2, which has been superseded by DOE ORDER 420.2A. DOE ORDER 420.2(A) essentially made the approved SAD the effective regulatory document.

Copies of specifications, standards, drawings and publications required by suppliers in connection with specified procurement functions should be obtained from the contracting agency or as directed by the contracting office.

Non-Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.
Environment Safety & Health Manual, Section 5.16 (ES&H 5.16) April 25, 2003, Argonne National Laboratory.
APS Safety Assessment Document (SAD), Rev 1, May 1999, Argonne National Laboratory, Argonne, IL.

Compliance with the following required by SAD:

Stanford Linear Accelerator Center Report 327 (SLAC 327), April 1988, Stanford Linear Accelerator Center, Menlo Park, CA.
National Council on Radiation Protection Report No. 88 (NCRP 88), Issued 30 December 1986, National Council on Radiation Protection.
Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.

Document No. 1111-00001-00 APS Quality Assurance Plan, dated May 1990.

1.5. Revision Record

Revision	Dated	Comments
-00	10/04/04	Create Document

1.6. Notes & Exceptions

All Input Signals are High True unless otherwise noted.

2. Equipment and Responsibilities

1.7. Overview

The PSS DIW system monitors the water flow to critical PSS components. It is required to be robust and fail safe in design. The design must be highly reliable to insure proper 24 hour operation. The design will provide the set point and actual process variable values to the EPICS for monitoring and logging.

1.8. Responsibilities and Interfaces

ASD Mechanical Engineering Group will be responsible for maintenance of flow and pressure monitoring components, piping, hoses, valving and insuring that required flow and pressure is maintained. The necessary critical component operating set points for each DIW flow loop controller will be supplied to the ASD Safety Interlock Group by a group to be defined by APS management.

ASD Safety Interlock Group is responsible for all aspects of the safety logic and control associated with the DIW system. ASD Safety Interlock Group will design, fabricate and install a chassis containing the necessary components to provide 24 VDC current loop power to the DIW transducers, convert the resulting 4 to 20 ma signal into human readable form and implement safety interlocks for the PSS for each flow loop monitoring beamline critical components. ASD Safety Interlock Group is also responsible for the electrical wiring between the PSS & DIW systems including grounding at the PSS cabinetry. The ASD Safety Interlock Group will work with the user community to provide isolated 4 to 20 ma flow loop signals as necessary. Flow loop signals provided to the users will be 4 to 20 ma 24 VDC designed to drive one 250 ohm load.

ASD Safety Interlock Group is responsible for all aspects of the design, programming, connection and maintenance of the EPICS interface.

The ASD Safety Interlock Group and the ASD Mechanical Engineering Group will work together to verify correct operation of the system as a whole. The PSS DIW validation will be performed the ASD Safety Interlock Group with the assistance if necessary of the ASD Mechanical Engineering Group.

1.9. Technical Requirements

The pressure transducers installed by the ASD Mechanical Engineering Group will be 4-20 ma loop powered and designed to operate with 24 VDC.

The ASD Safety Interlock Group currently has two DIW chassis designs. One design allows monitoring of 6 transducers or three redundant flow loops. The second design allows monitoring of 12 transducers or six redundant flow loops. Each flow loop will use two independent flow

transducers. They will be independently connected to the PSS Chain-A and Chain-B Emergency Shut Down programmable logic controllers using a normally open fail safe relay capable of controlling 100 ma at 24 VDC. The DIW chassis will provide 24 VDC to the loop powered flow transducers and convert this signal into human readable form. The chassis will also provide a means of entering set points defining the desired operating limits of the DIW flow loop.

The EPICS interface will convert the DIW RS-485 signal to a fiber optical signal for transmission to the EPICS IOC.

1.10. Safety Implications

The DIW system monitors the water flow to critical PSS components. It is required to be robust, redundant and fail safe in design. The must be a highly reliable design to insure proper 24 hour operation.

3. Interface Characteristics

The PSS DIW chassis is connected to the DIW transducers on a terminal strip in a panel provided by ASD Mechanical Engineering Group. The cable used to connect the PSS to the transducers will contain 12 twisted pairs of 20 AWG wire and be installed and terminated by ASD Safety Interlock Group. This cable will accommodate the maximum number of transducers that can be connected to 1 DIW chassis. Refer to the PSS to DIW Interconnection drawing for the full details of this interface. If additional monitoring is required an additional chassis and cable can be installed.

The EPICS interface converts the RS-485 electrical signal (to a fiber optical signal using an off the shelf B&B FOSTC converter) that contains the set points and process values needed to monitor proper operation of the DIW system.